

# WELLCLEAN II Simulator



Ensuring complete zonal isolation is the ultimate goal of cementing operations. However, this goal is seldom achieved. Typically 80% of survey wells show pressure between the casing and wellhead.

Because incomplete mud removal is a repeated source of unexpected costs for operators, every effort should be made to ensure critical zonal isolation on the first attempt.

## A unique downhole prediction

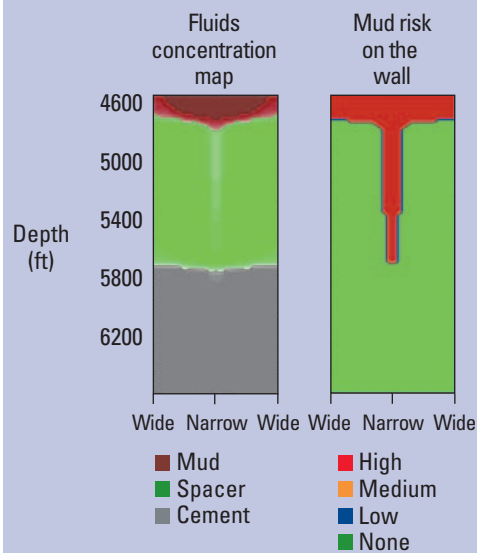
A two-dimensional numerical simulator, the WELLCLEAN\* II Simulator uses computational fluid dynamics physics to monitor the process of cement placement. Based on well geometry and trajectory, downhole fluid properties, volumes, pump rates and casing centralization, Schlumberger engineers predict the efficiency of mud removal and identify whether a mud channel will be left in place.

By entering data into the WELLCLEAN II Simulator, engineers can make the necessary design changes to optimize the operation and achieve the required degree of zonal isolation.

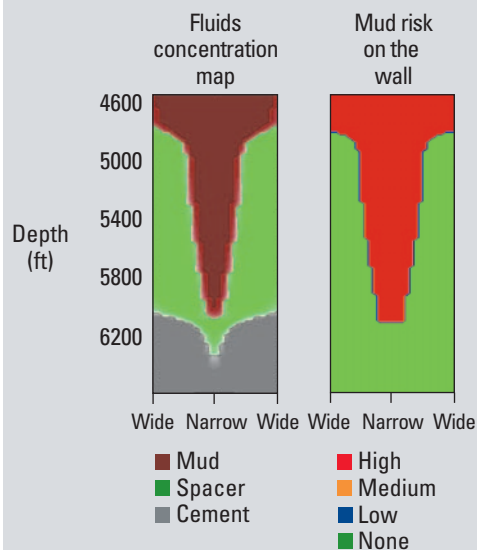
## Visualizing displacement patterns

Different displacement patterns visually displayed in the WELLCLEAN II Simulator guide the design engineer to make decisions that will result in the most efficient and complete form of mud removal.

*A piston-type displacement is the most stable, yielding the highest percentage of mud removal.*



*Dynamic channeling occurs when the fluids display low-yield stress.*



## Applications

- Mud removal and cement placement in vertical, extended reach or horizontal wells
- Simulation of fluid placement in turbulent and laminar flow

## Benefits

- Identify risk of leaving mud channel
- Reduce cost associated with mud removal by optimizing job design
- Predictable results validated by physical experiments and field performance

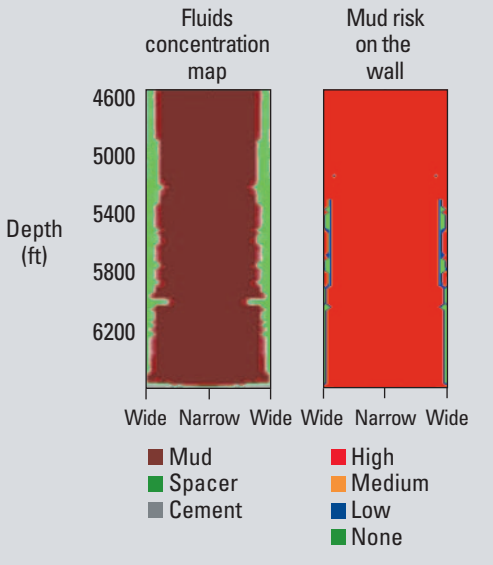
## Features

- Uses accurate rheological description of fluids (Herschel-Bulkley model)
- Maps fluid position and concentration in annulus
- Maps fluid velocity and flow regime
- Provides animated recording of fluid displacement process as a function of job time
- Detects any detrimental contact between mud and cement during displacement



Static channeling occurs when the displacing fluid bypasses the displaced fluid.

With the aid of the WELLCLEAN II Simulator to address mud removal in the design phase, Schlumberger engineers were able to improve zonal isolation.

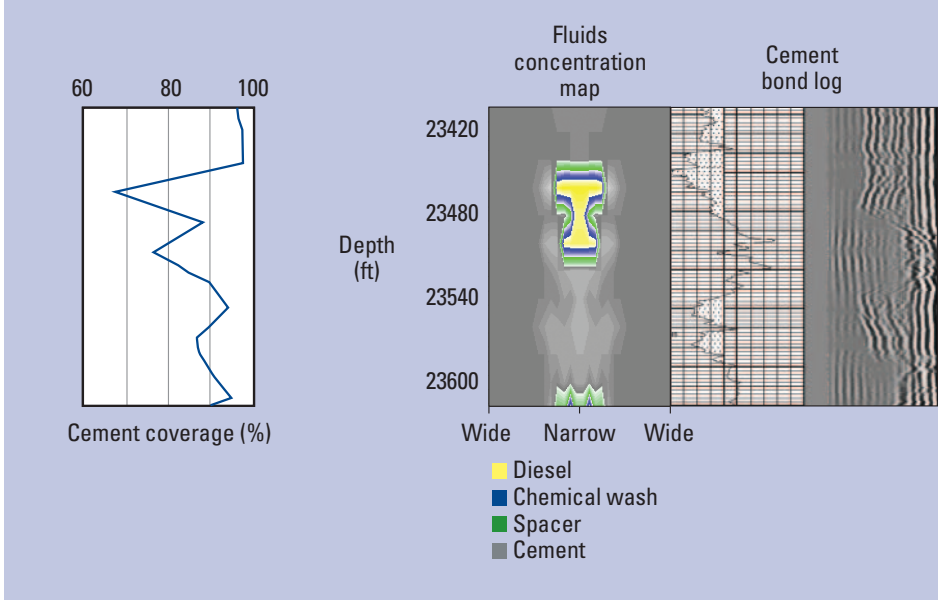
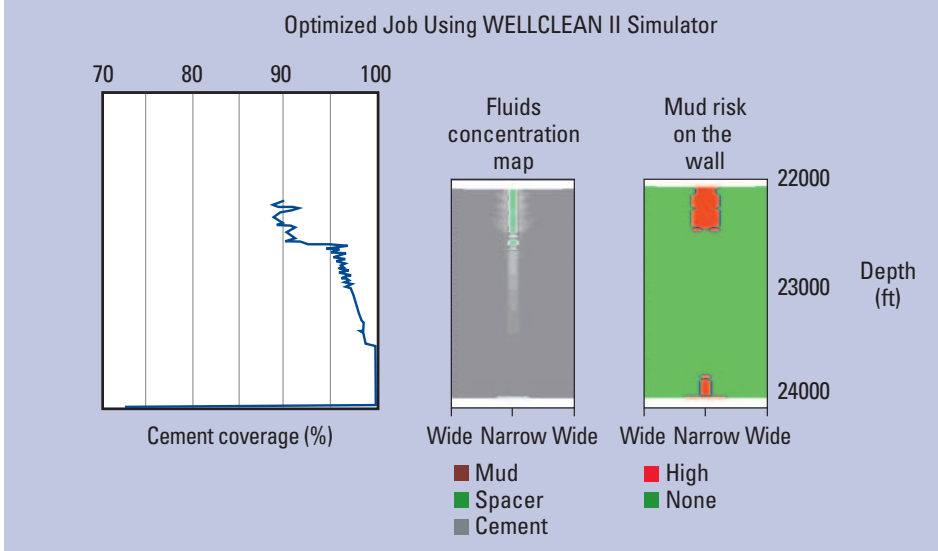
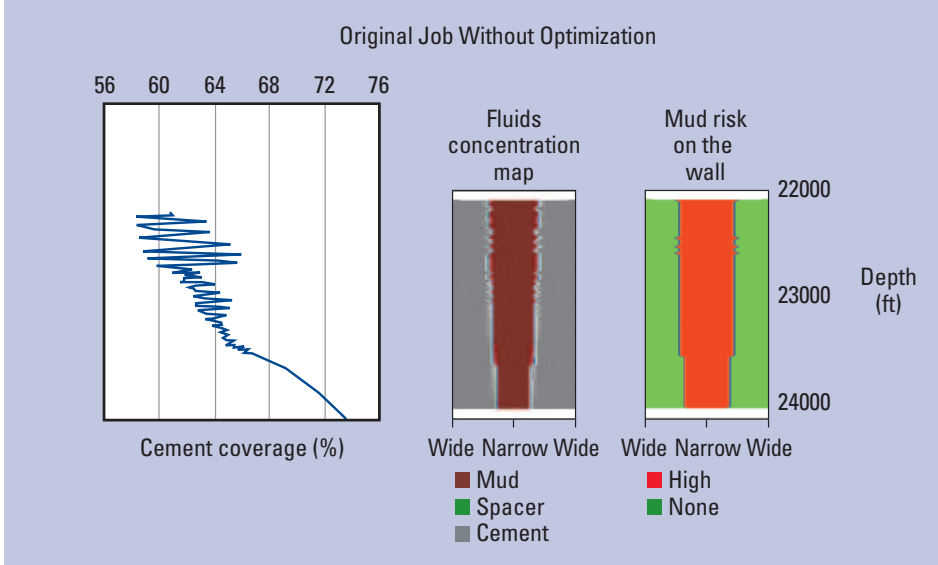


**Case history**

In the Gulf of Mexico, achieving effective zonal isolation was crucial for these costly extended-reach wells caused by the presence of both water and hydrocarbons within the pay zone. Interzonal communication between the water and hydrocarbon intervals was identified as the reason for lower productivity in previous wells. In order to remedy these defective primary cement jobs, the operator was spending a minimum of \$200,000 per well in squeeze cementing operations.

With the aid of the WELLCLEAN II Simulator, Schlumberger engineers were able to redesign parameters that contributed to inadequate mud removal. Results included improved centralizer placement, adjustment of spacer and cement fluid properties in addition to optimized volumes and rates.

The operator recognized an immediate change. Outputs from the WELLCLEAN II Simulator were in complete agreement with the cement evaluation acoustic logs. As a result of this improved mud displacement, the next three wells did not produce water and did not require a remedial squeeze operation.



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